COWLES FOUNDATION FOR RESEARCH IN ECONOMICS

AT YALE UNIVERSITY

Box 2125, Yale Station
New Haven, Connecticut

COWLES FOUNDATION DISCUSSION PAPER NO: 290

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April 8, 1970

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1. Introduction

In recent years a considerable volume of public outcries and expressions of indignation has focused on the claim that the poor pay more for the goods and services they buy than do their wealthier neighbors. Investigations of the urban riots of the middle 1960's have, for example, indicated that resentment against alleged unfair commercial practices by ghetto merchants, most of whom are white, is one of the many grievances which may have found expression in these disorders.[1]

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*The authors are Assistant Professor of Economics, Columbia University, and Assistant Professor of Economics, Yale University, respectively. They wish to thank the Mayor's office of the City of New York for making the data available; Fred Meir for supervising the preparation of the data; and Stephen Altheim, Betty Bockelman, Howard Kitt, David Molnar, and John McDonald for valuable research assistance. The authors are also indebted to Professors G.S. Becker, C. Bischoff, V.K. Chetty, D. Grether, J. Heilbrun, G.H. Kramer, P. Mieszkowski, J. Mincer, A. Rees, J. Tobin, and B. Weisbrod for their helpful comments and suggestions. These people, of course, are not responsible for any faults that remain.

This research was supported, in part, by the Office of Economic Opportunity through the Harlem Development Project, Columbia University Workshop for Development Planning, the Council for Research in the Social Sciences of Columbia University, the National Science Foundation, the Mobil Foundation, and the Ford Foundation.

This paper analyzes a comprehensive survey of food prices conducted in New York City during the summer of 1967 by the New York City Council on Consumer Affairs.[2] The central issue considered is whether or not the urban poor pay more for food than do urban residents with higher incomes. It is important to emphasize that this study only considers the cost of food purchases. In contrast, much of the controversy surrounding the question of inter-income differences in the cost of goods has focused on commodities other than food--particularly, on durable consumer goods. The results obtained in the present study do not carry any necessary implications for the cost to the poor of these other types of commodities. It would, for example, be especially inappropriate to try to extrapolate any of the results presented here to commodities for which installment buying and credit extension play a more important role than they do in the purchase of food.

Measuring how the cost of food varies with income level is not a straightforward matter. While a measure of the central tendency of the income distribution in a neighborhood might be acceptable as at least a first approximation to the "neighborhood's income," how does one measure the "cost of food"? Clearly, the prices of the commodities available in different neighborhoods constitute the basic data for any such measure of food costs. But there are other factors which should also be taken into account.

First, since families of different income levels purchase different (weekly or monthly) market baskets of goods, it is necessary to decide how the prices of the commodities are to be aggregated. Should the focus be

on the cost of the low-income family's market basket in all areas or should it be on the cost of the low-income basket in poor neighborhoods and the cost of the high-income one in more affluent regions? In either case, what corrections are to be made for varying tastes and other non-income demand-determining factors?

Second, how is a neighborhood price for a commodity to be determined? Since prices charged by large stores may differ markedly from those charged by small stores, how should the structure of the food-store population in a neighborhood be taken into account?

Third, if the stores in different neighborhoods are of varying "quality" or offer "extras" to differing degrees--decor, check-cashing facilities, credit opportunities, long hours, wide variety of products, delivery services, and so on--the prices charged by different stores for the same physical commodity will reflect these "quality of store" differences. It would be desirable to derive a "net price" series which adjusts the observed prices for the cost of these other store attributes.

Of even greater significance than variation in the quality of the stores in which consumers shop is variation in the quality of the particular items patrons of different stores can purchase. While careful specification of brand names and package sizes may limit this problem for packaged items, it is extremely difficult to standardize for the quality of produce, poultry, meat, and dairy products. Yet, if higher prices reflect higher quality products, any comparisons of the cost of a bundle of fixed-quality commodities would require adjustments for quality differences.

Lastly, the mobility of the consumer dictates the need for even more data. Since residents of one neighborhood are not restricted to shopping in that area alone, it would be useful to have information about where residents of different neighborhoods shop. This would allow inferences to be drawn between neighborhood income levels and costs actually paid or confronted by residents of the neighborhoods rather than simply about the relationship between neighborhood income and the prices charged by merchants in the given areas. And, since shopping in different neighborhoods or in different parts of one neighborhood will involve varying amounts of time, one would--ideally--want to include the cost of that time in the final cost of food.[3]

Unfortunately, the data available for the present study falls short of the level of detail just described. As a result, only a narrow aspect of this issue can be examined here. Specifically, the primary objective of the paper is restricted to determining whether there were differences in the retail food prices charged in New York City in the summer of 1967, and whether such differences--if they existed--can be systematically related to neighborhood income.

Using the price data from the New York City survey and data on median family income for forty-six neighborhoods in New York, the simple relationship between price and neighborhood income is investigated employing a single-equation linear regression model. Although this touches on only one aspect of the general question of whether or not the poor pay more for food, it is an important first step in addressing the problem. Moreover, we shall attempt to supplement the results of our estimation with some comments about how the measurement problems discussed are likely to affect the empirical results obtained.

The next section describes the linear regression models estimated in the study, and then Section 3 discusses the data employed. Section 4 reports the results of our investigation. The concluding section discusses the implications of these results and some important qualifications, as well as presenting suggestions for further research in this area.

It is well to conclude this introductory section with two more general qualifications. First, the establishment of the New York City Council on Consumer Affairs and the Council's undertaking of a comprehensive food price survey were themselves responses to the growing concern with consumer problems of the urban poor. It seems quite likely that some previously existing price differentials may have been partially eliminated as a result of the publicity emanating from this public concern. Second, the available data focus only on the actual prices of commodities. They can tell us nothing about what residents of poor neighborhoods believe is true about the relative cost of food in their neighborhoods. And it is, after all, the perception the poor have of their situation--not just the actual situation itself--which governs their attitudes and responses to society as a whole.

2. The Linear Regression Model

Turning now to the regression models used, the only systematic relationship to which the paper addresses itself is that between the price of a commodity in a store and the median family income of the neighborhood in which that store is located. With one exception, all other factors affecting the price of a particular commodity are subsumed in the error term.

Specifically, the sample of stores is stratified into two groups: stores which were members of a chain or were affiliated independents and stores which were small independents.[4]

Restricting the discussion, then, to the subgroups chains and affiliated independents (henceforth called "chain stores" and labeled C) and small independents (henceforth called "other stores" and denoted S), one might reasonably posit one of the following two relationships--in linear form--between the price of a commodity in a particular store (be it a chain or an independent) and the income of the neighborhood in which that store is located:

(1) $$p_{ij} = \alpha + \beta\, y_j + \epsilon_j + \eta_{ij} \,,$$

or

(2) $$p_{ij} = \alpha + \beta\, y_j + \sum_{j=1}^{N} \gamma_j\, D_j + \eta_{ij} \,.$$

The symbols in (1) and (2) are defined as follows:

p_{ij} = price of the commodity in the i^{th} store in the j^{th} neighborhood,

y_j = median family income in the j^{th} neighborhood,

ϵ_j = neighborhood-specific error term,

η_{ij} = store-specific error term,

D_j = a dummy variable assuming the value 1 if the store observation is in neighborhood j and the value 0 otherwise, and

N = total number of neighborhoods in the sample for the commodity in question.

Each of the error terms is assumed to satisfy the usual assumptions of ordinary linear regression: each is distributed with mean zero and scalar variance - covariance matrix. In addition, in equation (1) ϵ_j and η_{ij} are assumed to be independent of one another for all i, j.[5]

Each of the two models hypothesizes that there are four types of factors at work in determining the price observed for a commodity in a particular store in a specific neighborhood. First, as reflected in the stratification, the price depends on whether the store is a chain or a small independent store. Second, the level of neighborhood income affects the commodity's price. Third, there are other features specific to the store itself which affect the price of the commodity in that store. Finally, there are other neighborhood-related characteristics aside from neighborhood income which enter into the determination of the price.

It is with regard to their treatment of these other neighborhood-related characteristics that the two models differ. The hypothesis represented by model (1) is that these other neighborhood characteristics enter the price-determination via a stochastic process with mean zero and variance σ_ϵ^2. On the other hand, the model of equation (2) hypothesizes that the non-income neighborhood effect is nonstochastic.[6] This second model simply asserts that corresponding to each neighborhood there is a different deterministic intercept, the j^{th} neighborhood's intercept being $\alpha + \gamma_j$.

Despite the difference in the way they treat non-income neighborhood factors, no set of observations on the real world could enable a researcher

to distinguish between the two models. As just indicated, the force of the hypothesis embodied in (2) is that the intercept varies from neighborhood to neighborhood. But since the stochastic neighborhood-effects model asserts that once a random drawing is made from the chain (other) ϵ distribution for one chain (other) store in a neighborhood, that same number is added to the deterministic part, $\alpha^c + \beta^c y_j (\alpha^s + \beta^s y_j)$, of the price of the commodity for every chain (other) store in that neighborhood, the net implication of model (1) is the same as that of (2). In this study, both models are utilized. A special case of the price-determination models in (1) and (2) is estimated, and then the improvement in explanatory power resulting from use of the more general model as expressed in (2) is examined briefly.[7]

The special version of equations (1) and (2) which is estimated is called the store model. Maintaining the stratification between chains and other stores, the store model assumes that after taking account of differences in neighborhood income, any further variation in the price of a commodity in different stores can be explained by factors specific to the individual stores. The store model thus takes the following special form of (1) and (2):

$$p_{ij} = \alpha + \beta y_j + \eta_{ij} . \tag{3}$$

To gauge the superiority of the more general model (2) over the store model (3) an analysis-of-variance F-test is used which measures the statistical significance of constraining each γ_j in (2) to be zero. The test indicates how much explanatory power is lost if all variation in

neighborhood characteristics is assumed to be adequately summarized in the median family income level of the neighborhood. The relevant F-test statistic, commodity by commodity with stratification by type of store, is

$$(4)\quad \frac{\dfrac{\text{Sum of Squared Residuals in (3) - Sum of Squared Residuals in (2)}}{\text{Degrees of Freedom in (3) - Degrees of Freedom in (2)}}}{\dfrac{\text{Sum of Squared Residuals in (2)}}{\text{Degrees of Freedom in (2)}}} .$$

Two important aspects of the test based on the F-Statistic in (4) ought to be noted. First, the vector of income observations consists of N subvectors, one for each neighborhood, with each subvector containing as many elements as there were observations on the particular commodity in that neighborhood. Since there was only one price survey--and hence only one set of neighborhood income observations--the elements of any one subvector are identical, with each one equal to the particular neighborhood's median family income. As a result, the rank of the observation matrix in (2) is N rather than $N + 2$.[8]

The normal equations, in this case, define a 2-dimensional subspace rather than a point, and the individual parameters in (2) cannot be identified. To identify each of them, α , β , γ_j (j=1, ..., N), one would need two additional independent linear restrictions on the parameters. Any set of

estimates of the parameters of (2) which satisfies the normal equations will, however, yield the correct sum of squared residuals for (2) for use in the F-statistic in (4). In particular, if the two independent linear restrictions $\alpha = 0$, $\beta = 0$, are imposed, the equation obtained is

$$(5) \qquad p_{ij} = \sum_{j=1}^{N} \gamma_j D_j + \eta_{ij} ,$$

and the sum of squared residuals of equation (5) is the same as the sum of squared residuals of (2).

This brings us to the second point that ought to be noted about the sum of squared residuals of equation (2). As is immediately clear, the estimate of γ_j in (5) equals $\bar{p}_j$, the mean price of the commodity in the j^{th} neighborhood. Hence, the sum of squared residuals of equation (5), and thus of equation (2), equals

$$(6) \qquad \sum_{j=1}^{N} \sum_{i=1}^{N_j} (p_{ij} - \bar{p}_j)^2 ,$$

(where N_j is the number of observations on the particular commodity in the j^{th} neighborhood), that is, the sum of the within-neighborhood variation in prices. This observation serves to emphasize the analysis-of-covariance nature of the F-test described above.

3. The Data

The data on food prices gathered by the New York City Council on Consumer Affairs during the summer of 1967 appear to be at least as good as any yet collected to test the hypothesis that food prices vary inversely with neighborhood income.[9] The major virtues of the New York City Survey are its

extremely comprehensive coverage of commodities, stores, and neighborhoods, and its relatively precise specification of the commodities to be surveyed. Prices of thirty-seven food items were surveyed in approximately twenty-five stores in each of about forty-six of the city's neighborhoods,[10] beginning in June 1967 and continuing through the summer. Two neighborhoods were surveyed each day, generally a high-income area and a low-income or poverty neighborhood. This procedure diminishes the possibility that the data are biased because of correlation between the dates on which neighborhoods were surveyed and the neighborhoods' incomes.

The surveyed commodities were divided into two groups, twenty-three packaged items (List A) and fourteen fresh meats, dairy products, fruits and vegetables (List B). Several nationally advertised brands were specified for each item on List A so as to protect as carefully as possible against quality variations. Similarly, the fresh food items were specified as precisely as possible, for example, "pork chops, center cut, loin, No. 1 grade, price per pound," in an attempt to ensure comparability. A copy of the reporting forms is included as Appendix A.

Since no checks were run on the accuracy of the surveyors, certain precautions were taken in preparing the data for this study.[11] First, it should be noted that some of the neighborhoods in the sample were surveyed more than once. In all such cases the earliest survey was chosen in order to minimize the possibility of including pricing changes which resulted from the surveys themselves and/or radio broadcasts of their results.

The second type of precaution taken in selecting the data for use in the study involved the elimination of outlying observations. Some supposed

price observations were simply too far away from the rest of the observations to make it seem likely that they were, in fact, accurate. In some cases it appeared that the wrong size package was priced or that a multiple-package price was recorded as a per-package price. In the case of some of the List B commodities, it becomes difficult to believe that quality was held even nearly constant. As a result of such strongly suspected inaccuracies in the reported prices, the following commodities were eliminated from the analysis: butter, bacon, frankfurters, bologna, hamburger, and dried beans.

With regard to the remaining thirty-one items, an ad hoc attempt was made to cope with the problem of potential outliers. No systematic rule was followed. Histograms were plotted for each of the commodities. Each histogram was carefully examined and those observations which appeared to be wide of the mark were deleted. The resulting range for each commodity is listed in Appendix B, and is referred to as "modified data".

In presenting the empirical results, we shall report two sets of estimates of the price-income relationships for the thirty-one commodities. One set emerges from regressions with the modified data ranges while the other set results from estimation using all the data. We have more confidence in the modified data set.[12]

While two sets of price data are used to examine the basic hypothesis, each of them is used in conjunction with the same data on the neighborhoods' median family incomes. These income data are derived from the New York Market Analysis (1963) cited earlier. Unfortunately, these data contain information only about neighborhood incomes in 1960, while the price data are based on a 1967 survey.[13] The income data used are, however, the only ones available that are fully consistent with the delineation of neighborhoods used in the study.

A final precaution was required because the sample of stores in the N.Y.C. survey was not designed to be representative of the store populations in each neighborhood.[14] Separating chains and affiliated independents from other stores[15] and comparing the distributions of stores in the sample with the distributions of stores in the respective populations,[16] one finds that in all but one neighborhood, the percentage of chain stores in the sample exceeds that in the population. If one were willing to make some further assumptions about missing observations, this finding would not disturb interneighborhood comparisons if the degree of overrepresentation of chain stores was the same in each neighborhood. This, however, is not the case. Instead, chain stores and affiliated independents tend to be significantly more overrespresented in the samples from neighborhoods with fewer chain stores in the population relative to those areas with more chain stores. Moreover, since not all commodities were found in all stores, the proportion of chain stores in the sample in a neighborhood varies from commodity to commodity, which further compounds the unrepresentativeness of the sample.[17]

As a result of this nonrepresentativeness of the neighborhood samples of stores, discussions of results based on a pooling of all observations on a commodity would be highly precarious. It is because of this fact that, as indicated earlier, the sample is stratified into chain stores and other stores, and this stratification is maintained throughout the analysis.

4. The Empirical Results

Turning to the empirical results, consider the estimates obtained for the store model, represented by equation (3), using the modified data and all

the data. Table 1 presents the signs of the income (β) coefficients for commodities in chain stores and indicates with asterisks those coefficients which were significant at the 5 percent level. Table 2 presents the same information for commodities in other stores. In each table, the list of commodities is divided into two parts by a horizontal line, the division occuring between the List A (packaged items) and the List B (quality - problem items) of the survey.

The most striking aspect of the results is the fact that no matter which set of data one considers, rarely does the price of a commodity tend to increase as the median family income of the neighborhood decreases. In general, the price-income relationships found commodity by commodity, in both chain stores and other stores, are insignificant or show that the commodity's price rises with the level of neighborhood income. The only commodities which exhibit significant negatively sloped price-income relationships are corn flakes and chuck steak in the other stores. In the case of corn flakes the coefficient is negative and significant regardless of which data set is employed, while chuck steak has a significant negative income coefficient only in the regression based on all the data in the sample. Tables 3 and 4 present all the significant income coefficients, measured in cents per $10,000 of income change, and their t values for commodities in chain stores and other stores respectively.

The coefficients of determination of the estimated equations are not very impressive. In the case of the chain-store relationships, only one of the significant equations using all the data and none of the significant

TABLE 1

Signs of Income Coefficients - Chain Stores

Modified Data		All Data	
> 0	< 0	> 0	< 0
Margarine	Orange Juice	Margarine	Corn
Cheese*	Tuna Fish	Cheese*	Broccoli
Cottage Cheese	Coffee-Canned	Cottage Cheese	Orange Juice
Flour*		Flour*	Baby Food-Meat
Peas*		Peas*	Tuna Fish
Corn		Green Beans	
Grean Beans		Baby Food-Veg.	
Broccoli		Corn Flakes	
Baby Food-Meat		Rice*	
Baby Food-Veg.*		Sugar	
Corn Flakes		Coffee-Canned	
Rice		Coffee-Instant	
Sugar		Coca Cola	
Coffee-Instant		Beer	
Coca Cola*			
Beer			
		Milk	Pork Chops
Milk*		Eggs	
Eggs*		Steak-Sirloin*	
Steak-Sirloin		Steak-Chuck	
Steak-Chuck*		Chuck Roast	
Chuck Roast		Chicken Breasts*	
Pork Chops		Chicken Whole*	
Chicken Breasts		Bananas*	
Chicken-whole*		Tomatoes*	
Bananas*		Potatoes*	
Tomatoes*		Lettuce	
Potatoes*			
Lettuce			

Notes: * denotes significance at the .05 level.

TABLE 2

Signs of Income Coefficients - Other Stores

Modified Data		All Data	
> 0	< 0	> 0	< 0
Margarine*	Flour	Margarine*	Corn Flakes *
Cheese*	Corn	Cheese*	
Cottage Cheese	Baby Food-Veg.	Cottage Cheese	
Peas*	Tuna Fish	Flour	
Green Beans*	Corn Flakes*	Peas*	
Broccoli*		Corn	
Orange Juice*		Green Beans*	
Baby Food-Meat*		Broccoli*	
Rice*		Orange Juice*	
Sugar*		Baby Food-Meat*	
Coffee-Canned*		Baby Food-Veg.*	
Coffee-Instant		Tuna Fish	
Coca Cola*		Rice*	
Beer		Sugar*	
		Coffee-Canned*	
Milk*	Steak-Chuck	Coffee-Instant	
Eggs*		Coca Cola*	
Steak-Sirloin		Beer*	
Chuck Roast			
Pork Chops*		Milk*	Steak Chuck*
Chicken Breasts*		Eggs*	
Chicken-Whole*		Steak-Sirloin	
Bananas*		Chuck Roast	
Tomatoes*		Pork Chops*	
Potatoes*		Chicken-Breasts*	
Lettuce*		Chicken-Whole*	
		Bananas*	
		Tomatoes*	
		Potatoes*	
		Lettuce*	

Notes: * denotes significance at the .05 level.

TABLE 3

Significant Income Coefficent (Cents per $10,000) - Chain Stores

Commodity	Modified Data	All Data
Cheese	+2.7 (2.39)	+2.7 (2.39)
Flour	+3.4 (3.12)	+3.8 (2.54)
Peas	+1.5 (2.27)	+1.6 (2.26)
Baby Food-Veg.	+0.6 (2.61)	
Rice		+2.7 (5.54)
Coca Cola	+3.8 (3.45)	
Milk	+2.0 (5.61)	
Eggs	+3.5 (2.50)	
Steak-Sirloin		+17.6 (2.79)
Steak-Chuck	+8.0 (2.70)	
Chicken Breasts		+13.1 (2.54)
Chicken-Whole	+9.3 (3.43)	+8.5 (2.91)
Bananas	+1.5 (2.51)	+1.4 (2.30)
Tomatoes	+24.0 (4.78)	+39.4 (7.75)
Potatoes	+12.4 (3.73)	+13.9 (3.93)

Notes: The numbers in parenthesis are t values.

TABLE 4

Significant Income Coefficients (Cents per $10,000) - Other Stores

Commodity	Modified Data	All Data
Margarine	+6.8	+7.9
	(3.51)	(3.60)
Cheese	+7.7	+8.0
	(6.25)	(5.74)
Peas	+2.3	+5.2
	(2.82)	(4.72)
Green Beans	+2.7	+4.1
	(3.73)	(4.58)
Broccoli	+3.3	+5.1
	(2.86)	(3.57)
Orange Juice	+2.8	+5.8
	(2.80)	(4.79)
Baby Food-Meat	+3.2	+7.1
	(2.21)	(2.28)
Baby Food-Veg.		+2.2
		(1.97)
Corn Flakes	-3.2	-3.8
	(4.06)	(3.56)
Rice	+3.3	+5.9
	(8.64)	(9.68)
Sugar	+6.8	+7.5
	(5.94)	(5.39)
Coffee-Canned	+3.9	+5.7
	(2.46)	(3.24)
Coca Cola	+5.6	+9.0
	(4.93)	(5.36)
Beer		+3.3
		(2.11)
Milk	+4.0	+4.9
	(10.84)	(8.25)
Eggs	+6.5	+9.8
	(4.09)	(5.57)
Steak-Chuck		-25.0
		(2.28)
Pork Chops	+42.0	+41.7
	(6.49)	(6.30)
Chicken Breasts	+21.4	+40.0
	(2.51)	(5.08)
Chicken-Whole	+5.9	+7.7
	(2.32)	(2.40)
Bananas	+5.6	+8.3
	(10.61)	(7.68)
Tomatoes	+33.7	+36.2
	(9.91)	(10.21)
Potatoes	+25.5	+25.5
	(8.89)	(8.89)
Lettuce	+12.5	+12.6
	(7.36)	(6.73)

Notes: The numbers in parenthesis are t values.

modified-data equations explains more than 10 percent of the variation in prices. The model's performance is better for other stores where almost one-third of the significant relationships, using either data set, explain more than 10 percent of the respective variances. But even among the significant equations for other stores, only two equations based on the modified data and one equation based on all the data have an R^2 in excess of .20 . For both the significant chain-store and significant other-store equations, the explanatory power of the model is greater for the prices of items on List B than it is for those on List A.

The weak explanatory power of the equations is somewhat less disturbing when one recalls that our main concern is not with presenting a full explanation of food-price determination but rather with determining whether or not there is a significant relationship between food-price levels and neighborhood-income levels. Thus we are more interested, as the formats of the tables suggest, in the t statistics than in the coefficients of determination. The low levels of the R^2 do, however, serve to reinforce our contention--stated in Section 1 -- that a fuller (perhaps, simultaneous-equation) investigation of food-price determination is desirable. Furthermore, the low coefficients of determination are symptomatic of some model misspecification--omitted variables, incorrect functional form, or the like. It should be recognized explicitly that a more satisfactory specification of the price-determination process might affect the level and the significance of the income coefficients obtained here.

The rates of change in price with respect to income vary fairly widely across commodities, but many of them are rather high. For the significant

negatively sloped relationships, the estimated income coefficients imply that as median neighborhood family income decreases by $10,000, the other-store price of a box of corn flakes will rise by approximately 10 percent of its mean value in all other stores, and the other-store price of a pound of chuck steak will increase by approximately 40 percent of its mean value in all other stores. The prices of many items with significant positive price-income relationships rise as much as 10 percent or more of their mean price for a $10,000 increase in income. For some commodities the variation is much greater, particularly among the List B commodities where quality variation would seem to be a more significant issue.[18]

The results in Tables 1 - 4 also suggest an interesting relationship between the rates of change of prices in chain stores and these rates of change in other stores. First, the number of significant price-income relationships in the other stores is much larger--approximately double--than the number of significant relationships in the case of chain stores. Second, the prices of more items rise <u>significantly</u> with income in other stores than in chain stores using either data range, <u>and</u> the only two significant negatively sloped relationships arise among the other stores.

Third, when a commodity's price changes significantly with income in both chain and small independent stores, the rate of change of price with income is usually greater in the small independent stores. Chuck steak and whole chicken are exceptions to this general comment. There also are commodities for which price rises with income in chain stores but not in other stores--for example, flour and sirloin steak. The general impression conveyed by the

results is, however, that prices rise faster with income in small independent stores than in chain and affiliated independent stores.

One further observation on the relationship between prices in chain stores and prices in other stores may be made conveniently at this time. Examining all the data in the sample and the modified data, one finds that for all nineteen items on List A--the packaged items--the mean price in other stores equals or exceeds the mean price in chain stores. The situation with List B--the items where controlling for quality is more difficult--is somewhat different. In the case of all the data, five of the twelve commodities on List B have higher mean prices in the chain stores than in other stores--milk, chuck roast, pork chops, tomatoes, and potatoes. When attention is confined to the modified data only, seven of the twelve commodities where quality control is a problem show higher mean prices in chain than in other stores--milk, sirloin steak, pork chops, chicken breasts, bananas, tomatoes, potatoes.[19]

Having estimated the store model (3) using all the data and a modified set of data and having considered the implications of the results, let us now test the adequacy of the store model vis-à-vis the general model (2). To compare these two models--alternatively, to measure the adequacy of the income variable as representation of the neighborhood factors relevant to food-price determination--the analysis-of-variance F-test described in Section 2 and summarized in equation (4) was performed. The test was carried out for each commodity in chain stores and then for each commodity in other stores, using only the modified data in each case.

TABLE 5

F - Tests

Commodity	$F(V_1, V_2)$ - Chains	$F(V_1, V_2)$ - Other
1. Margarine	F(43,253) = 1.6535*	F(41,245) = 1.9260*
2. Cheese	F(38,272) = 0.9710	F(37,442) = 2.3350*
3. Cottage Cheese	F(38,189) = 0.8110	F(38,258) = 1.5853*
4. Flour	F(44,310) = 1.6033*	F(43,400) = 1.9177*
5. Peas	F(44,308) = 1.5687*	F(42,337) = 2.0128*
6. Corn	F(43,290) = 1.3963	F(44,412) = 1.9575*
7. Green Beans	F(42,165) = 1.0816	F(42,327) = 1.1254
8. Broccoli	F(40,138) = 0.9441	F(41,311) = 2.1167*
9. Orange Juice	F(44,287) = 1.5321*	F(41,371) = 2.1443*
10. Baby Food-Meat	F(43,160) = 1.1123	F(41,172) = 0.9385
11. Baby Food-Vegetable	F(44,328) = 1.2927	F(43,566) = 2.6315*
12. Tuna Fish	F(44,294) = 1.9480*	F(44,515) = 2.4623*
13. Corn Flakes	F(44,317) = 1.3778	F(44,544) = 2.2265*
14. Rice	F(44,312) = 0.9667	F(44,688) = 3.0998*
15. Sugar	F(37,216) = 2.8706*	F(39,567) = 4.6295*
16. Coffee-Canned	F(44,337) = 1.8350*	F(44,636) = 4.9635*
17. Coffee-Instant	F(43,316) = 1.7070*	F(44,427) = 2.6616*
18. Coca Cola	F(44,307) = 1.6828*	F(44,665) = 1.0658
19. Beer	F(44,327) = 2.2114*	F(44,706) = 3.9798*
20. Milk	F(38,270) = 1.8193*	F(38,613) = 3.4458*
21. Eggs	F(38,259) = 2.1054*	F(38,555) = 1.8838*
22. Steak-Sirloin	F(38,192) = 2.0875*	F(31,68) = 0.8309
23. Steak-Chuck	F(37,208) = 1.6152*	F(29,61) = 0.9391
24. Chuck Roast	F(36,146) = 1.5245*	F(25,37) = 0.6158
25. Pork Chops	F(38,225) = 1.3884	F(33,173) = 1.7855*
26. Chicken Breasts	F(37,202) = 0.8739	F(32,69) = 0.6621
27. Chicken-Whole	F(38,200) = 1.4026	F(34,182) = 2.1880*
28. Bananas	F(38,256) = 2.0629*	F(36,391) = 3.1616*
29. Tomatoes	F(37,195) = 5.3131*	F(36,339) = 4.6648*
30. Potatoes	F(38,252) = 1.0567	F(36,377) = 1.5364*
31. Lettuce	F(37,249) = 2.6362*	F(36,341) = 1.9449*
Number Significant	18	24

Notes: * indicates significance at the .05 level. The most relevant critical F-values are:

$F(30,120) = 1.55$

$F(30, \infty) = 1.46$

$F(40,120) = 1.50$

$F(40, \infty) = 1.39$

The results of the F tests are presented in Table 5, and they can be summarized briefly. Including the neighborhood dummy variables in addition to income--that is, using the general model in (2) rather than the store model (3)--improves significantly (at the .05 level)[20] the performance of the store model in the case of 18 commodities in chain stores and 24 items in the other stores. The main observation one can make about the results of the F tests is that the dummy variables seem to be more important for small independent stores than for chains and affiliated independents. As just noted, more of the F values were significant in the former case. Moreover, for 22 of the 31 commodities the F-value in other stores exceeds that value for the chain-store counterpart, and for only four commodities was the F-value significant in chains but not in other stores. The fact that the dummy variables seem to be more important in the small independent stores than in the chains and affiliated independents is consistent with our concern that the "quality" of these stores may vary directly with neighborhood income.

5. Implications of the Results

The empirical results suggest that with the exception of corn flakes and chuck steak in small independent stores, the price of a given commodity in a particular type of store tends to be unaffected by or to rise with an increase in the level of neighborhood income.[21] As the discussion in Section 1 indicated, the question of whether or not the poor pay more for food is broader than the question this paper has been able to answer. Hence, these results--that food prices in chain stores and in other stores, taken separately, do not tend to fall as neighborhood income

rises--cannot be interpreted as meaning that the cost of food is lower for the urban poor than for richer city dwellers. Instead, these results enable one to focus attention on the ways in which the poor may be paying more for food. Since most of these other factors have been indicated in the introductory section's discussion of difficulties in measuring the cost of food, we shall indicate only briefly their bearing on the results obtained.

First, one must recognize that while most individual commodity prices appear to remain unchanged or to rise as neighborhood income rises, this does not imply that the price for a weekly or monthly market basket, taken as a single unit, rises as neighborhood income rises. Second, while the direction of commodity price variation with income are similar for both chain stores and other stores, for most commodities the mean price of the item is higher in other stores than in chain stores. At the same time a number of studies have shown that low-income neighborhoods have a higher proportion of small independent stores than do higher-income areas.[22] Hence, if prices are generally higher in other stores than in chain stores, the poor may be forced to pay more as their shopping opportunities consist largely of small, independent stores.[23]

Two other aspects of food-shopping opportunities which have a bearing on the cost of food in different neighborhoods are the relative availability of private-label commodities and the "quality" of stores in different areas. Private-label items offer the consumer opportunities for substantial savings compared to the advertised brands with which they compete.[24] But these opportunities exist only to the extent that chain stores and affiliated independents are present in a given neighborhood, and in this

respect low-income regions are not nearly as well-endowed as are more affluent areas. The issue of store quality is a more difficult one to assess but, nevertheless, it may be an important factor in determining the cost of food. Insofar as stores in more affluent neighborhoods offer relatively better-quality service[25] the poor family is getting less for a given expenditure, and the observation that prices rise with neighborhood income may be simply a reflection of this fact. Correcting for such "quality of store" features might lead to the conclusion that the poor do, in fact, pay more for food items other than chuck steak and corn flakes. Such changes in sign pattern might be expected particularly in the other stores' results since other stores in low-income neighborhoods tend to compare much less favorably with other stores in high-income neighborhoods than members of chains in the low-income areas compare with their high-income counterparts.

Fifth, and related to the quality of stores but of greater importance is the quality of particular commodities available in stores in different income areas. This problem should not seriously affect the results for List A (the packaged) items but could affect the results obtained for the produce, poultry, dairy, and meat products of List B. If the quality of items offered in higher income areas is better than that of commodities offered in low-income regions,[26] the results are surely biased toward a positive relationship between price and income.

The poor may actually pay more for food for another set of reasons investigated by the recent Federal Trade Commission (FTC) study, namely, the mispricing and inadequate stocking of advertised special items in low-income neighborhoods. It appears from the Commission's study that (1) advertised items are less available in chains in low-income areas than in chains in

high-income areas, and (2) in both rich and poor neighborhoods, individual members of chains fail to mark down advertised price specials to the correct price.[27] Such shortcomings in the food-distribution system would not be recognized by the New York City Survey data.

A final way in which the poor may pay more for food involves what is probably one of the most controversial issues concerning food-store pricing. It is the question of whether food stores in poor areas raise their prices on the days when food stamps and welfare checks are issued.[28] Although the present study can offer no evidence on this question, it is clear that such practices, if they exist, could be curbed or eliminated quite easily by a simple welfare-policy change, namely, by staggering the distribution of welfare checks within poor neighborhoods, just as social security payments are staggered.

In summary, the regression results of this study suggest that commodity by commodity with few exceptions, the prices of food items on retail merchants' shelves do not rise with decreases in neighborhood income. The cost of food may, in fact, be greatest to the poor but a complete investigation of this issue will require data and discussion which go beyond the level of relative prices in stores serving areas with different incomes. It is at this level, however, that most of the discussion has taken place. The following steps would seem to be suggested for further research on this question: (1) a study of market-basket prices in the context of the food-purchasing patterns of different income groups, (2) a study of the relationship of prices charged to shopping opportunities available in different neighborhoods and the use of more representative samples, (3) development

of a method for taking account of differences in store quality, (4) a survey with more careful control for quality variation among commodities, and (5) supplementation of the more general price-level studies with case-study investigations, similar to the one pursued by the FTC, of the availability of advertised items, the actual versus the advertised pricing of such items, and the validity of the welfare-check assertion. These suggestions essentially constitute an outline of a program of future research into the question of whether or not the poor pay more for food.

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FOOTNOTES

1. See, for example, the National Advisory Commission on Civil Disorders (1968, pp. 143-148, 274-277).

2. The New York City Council on Consumer Affairs was established by executive order of Mayor John V. Lindsay on April 23, 1967 to coordinate and improve the consumer protection and consumer education programs of the City. See the New York City Council on Consumer Affairs (1967) for a more detailed description of the study.

3. See Becker (1965) for a discussion of the role of time in economic decision-making.

4. The stratification is used because of weaknesses in the data which will be taken up in Section 3.

5. The general model presented in (1) is formally identical to the model developed by Balestra and Nerlove for deriving estimates based on data from a time series of cross sections. See Balestra and Nerlove (1966).

6. It should be noted that in addition to non-income neighborhood effects, the coefficients of the dummy variables may also reflect nonlinearities in the relationships between prices and neighborhood incomes.

7. Another extreme version of the general model in equation (1), call it the neighborhood model, assumes that $\eta_{ij} = 0$ for all i, j. That is, the variance of prices within each neighborhood is taken to be zero by this model, which can be estimated in the form

$$\bar{p}_j = \alpha + \beta y_j + \epsilon_j$$

($\bar{p}_j$ is the mean price of the commodity in the stores of the type being considered in the j^{th} neighborhood). This model, however, can be rejected out of hand since there are differences among prices in the various neighborhoods. We have, however, estimated the neighborhood model and the results, which generally agree with those of the store model, are available upon request.

8. This problem with equation (2) is just slightly more complicated than the usual inability to estimate an intercept term along with the coefficients of an exhaustive set of dummy variables.

9. A tabular summary of recent food price surveys is contained in Federal Trade Commission (1969, Appendix 111, pp. 43-44).

10. The definitions of the neighborhoods covered in the study correspond rather closely to the neighborhood definitions of the New York Market Analysis surveys of retail trade, population and housing. These reports--prepared and copyrighted in 1961 and 1963, respectively, by the New York Mirror, New York News, New York Times and General Outdoor Advertising Company--are also the sources for the other data used in this paper, namely, neighborhood populations and incomes, and the populations of stores in each neighborhood. They were prepared from the 1960 Census of Population and Housing and special tabulations of the Bureau of the Census concerning retail trade. See New York Market Analysis, (1961 and 1963).

11. The surveyors for the New York City Survey entered the stores unannounced and recorded the prices as they found them marked on the commodities on the shelves. Only if they were questioned did they identify the purpose of their visit to the store, and if their activity was then interfered with by the manager or another employee, they left the store and deleted it from the sample. Although this procedure has its deficiencies and may import an upward bias to the income coefficients, it would appear to be an improvement over the way the BLS study went about collecting its data. The BLS notified the headquarters of the chain stores to be surveyed of the impending study, and arranged to call at the individual stores when the managers would be available. The independent stores, on the other hand, were not informed of the study in advance. See Ridgeway (1966).

12. The price-income relationships were also estimated using a third set of data. These data were constructed by calculating the ranges of prices for each of the thirty-one commodities in the Bedford-Stuyvesant neighborhood, a large, low-income area in Brooklyn. The range used for each commodity was then taken to be three times the length of the Bedford-Stuyvesant range for the commodity, with the latter as the middle third of the total range. The ranges derived using this procedure are sometimes extremely narrow. The results of estimating models (2) and (3) with these data are not presented here. They are, however, in general agreement with the two sets of results presented here, and they are available from the authors upon request.

13. The fact that the income and price data do not refer to the same year creates an errors-in-variables problem for the regressions. This measurement error, taken alone, would, if uncorrelated with the true value of income and the disturbance term, bias the income coefficients toward zero. See Johnston (1963, pp. 148-150).

14. This was also true of the sample in the Bureau of Labor Statistics study. Moreover, in order to derive averages of chain-store prices for the commodities in each region, the BLS used a rather inaccurate weighting

procedure. They assumed that the distribution of chain-store sales among the several chains was the same in the low-and high-income areas of each city. See Dixon and McLaughlin (1968, p. 7), and Alexis and Simon (1967, pp. 439-440).

15. This is almost equivalent to dividing the sample into large and small stores because of the high correlation between the number of stores in each neighborhood which are chain stores and the number which have high sales volumes.

16. Since the population data refer to 1960 and the sample data to 1967, there are some instances in which the number of stores in the sample exceed those in the population. Thus, this comparison is, at best, only suggestive of the true situation. See Alcaly (1968, Table 1, pp. 175-176).

17. This entire discussion ignores the question of how the stores within each neighborhood were selected. No systematic guide was given to the surveyors. As a result, the stores sampled in a neighborhood tend to be closer together than those in the neighborhood populations. If one believes that proximity generates greater competitive pressures, this could lend to a narrowing of the ranges of prices observed in each neighborhood.

18. An example from List A is the price of a jar of meat baby food in other stores, which is estimated to increase in price between 3.2 cents and 7.1 cents per $10,000 rise in income while its mean price in all such stores is 21.9 cents. Two examples from List B are the price of tomatoes in chain stores and the price of potatoes in other stores. The price of one pound of tomatoes in chain stores rises at a rate between 24.0 cents and 39.4 cents per $10,000 increase in neighborhood median family income while the mean price of tomatoes per pound in all chain-store data was 51.5 cents. For potatoes in other stores, the estimated equations suggest that a $10,000 increase in neighborhood median family income would increase the price of a five-pound bag of potatoes about 25 cents, compared with a mean price in all non-chain stores of 41.4 cents per five-pound bag.

19. The tendency for prices in small independents to exceed those in chain stores and affiliated independents is perhaps the major conclusion of previous studies of food prices in low-income and high-income areas. See, for example, BLS (1966), Alexis and Simon (1967), Dixon and McLaughlin (1968), and Goodman (1968).

20. Because precise critical F-values were not available for the degrees of freedom in the regressions estimated, it was necessary to use some rough interpolation of the published values in evaluating the F-tests. In most cases this did not present any real problem with the possible exception of corn and whole chicken in chain stores. It is possible

that our judgment (that the F-value was not significant) is in error in these two instances, but such an error would not greatly affect the overall picture of the results.

21. Of course, the regression results represent the price-income relationships for the various commodities only across the entire sample of neighborhoods. For any small subset of neighborhoods (for example, one high-income neighborhood and one low-income neighborhood) a price-income relationship may exist which is opposite in direction to the one observed in the aggregate equation.

22. See Alcaly (1968, Table 2, p. 177), BLS (1966 , p. 122), and FTC (1969, pp. 4, 13-20).

23. In addition, because there is less competition among chains and affiliated independents in poor areas than there is among such stores in wealthier areas, there are likely to be fewer special price reductions in low-income area stores. See FTC (1969, pp. 3-4, 33). Such special competitive-situation price-cutting would not have been recognized explicitly in the New York survey data available.

24. Private label brands were essentially omitted from the New York City survey, an omission which is also characteristic of the BLS and other studies. The only item for which a private label was specified in the New York survey is milk. (See Appendix A.) Although it did not physically analyze private label brands, the National Commission on Food Marketing asserts that retailers' top lines of private label commodities are generally comparable in quality to their national-brand competitors. The Commission also found, in a 12-week analysis of 10 commodities in 11 retail chains in 11 cities, that "on the average, the advertised brand price was about 20 percent higher than the private label product with which it competed." See National Commission on Food Marketing (1966, pp. 133-138, especially Table 6-3).

25. Although the evidence on this point is sketchy, what evidence there is suggests that stores in high-income areas, particularly the small independents, tend to offer more "extras" than stores in poorer regions. See, for example, BLS (1966, pp. 130-138) or FTC (1969, p. 16).

26. Although most of the popular literature suggests that the quality of commodities and income do vary directly it is interesting to note that while the recent FTC study found the appearance of meat items in chain stores in low-income areas to be somewhat worse than the appearance of the same items in chains in high-income neighborhoods, laboratory tests by the Department of Agriculture revealed no significant difference in the actual quality of the meats available in the two types of neighborhood. See FTC (1969, pp. 37-39). Similarly, in its own study, the Department of Agriculture found that "an analysis of selected factors associated with quality for a limited number of meat products showed considerable variation among stores of a chain but no definite pattern by income areas of the city." See United States Department of Agriculture (1968, p. 1).

27. FTC(1969, pp. 4-5, 26-32). Occurrences of the former type would certainly constitute a means by which the poor pay more for food, while the second phenomenon would lead to outcries by the poor of unfair treatment, and these outcries would be justified in an absolute sense. But while deviations from advertised prices mean the poor pay more for food than the advertisements say they should, they are not necessarily paying more relative to the residents of higher income areas in the same city. For example, the FTC study found that for Washington, D.C. the upward deviations from advertised price specials were greater in the chain stores in high-income areas than in their low-income area counterparts. See FTC (1969, pp. 26-29).

28. It was precisely this allegation made by the Ad Hoc Committee on Equal Pricing, Washington, D.C., in September 1967 concerning low-income-area members of a Washington, D.C. chain that served as the final catalyst to the FTC study. The study report indicates that it found no evidence of such practices in Washington, D.C. It should be noted, however, that all of the study's investigations were carried out after the allegation had been made public and, as the study's report states, "at a time when a great deal of public attention was focused on the problem of food-pricing in low-income areas, specifically on allegations that food chains had been discriminating against residents of these areas." FTC (1969, p. 25).

APPENDIX A

REPORTING FORMS FOR THE SURVEY

MAYOR'S COUNCIL ON CONSUMER AFFAIRS

Consumer Price Survey

Name of Store_____ Size_____

Address of Store_____

Borough and District_____

Name of Surveyor_____ Date_____

Notation_____

List A

*____ 1) Butter, salted, quarters, brand per 1 pound
Breakstone, Hotel Bar, _____

____ 2) Margarine, brand per pound
Nucoa, Parkay, _____

____ 3) Cheese, American, Pasteurized, sliced in 8 oz. package
Kraft, Borden, _____

____ 4) Cottage Cheese, small curd, 1/2 pound
Breakstone, Crowley, _____

____ 5) Flour, all purpose, 5 lb. bag
Gold Medal, Pillsbury, _____

____ 6) Bacon, sliced, per lb.
Plymouth Rock, Oscar Mayer, Krauss, Swift _____

____ 7) Frankfurters, all meat, per lb.
Plymouth Rock, Oscar Mayer, Krauss, Swift _____

____ 8) Bologna, sliced, packaged, 6 oz.
Plymouth Rock, Oscar Mayer, Krauss, Swift _____

____ 9) Peas, canned, 16-17 oz.
Green Giant, Del Monte, _____

____10) Corn, niblets, canned, 12 oz.
Green Giant, Del Monte, _____

____ 11) Green beans, cut, frozen, 9-10 oz.
Birds Eye, Snow Kist _____

____ 12) Broccoli spears, frozen, 10 oz.
Birds Eye, Snow Kist _____

____ 13) Orange juice, frozen, 6 oz.
Minute Maid, Snow Crop _____

____ 14) Baby food, strained meat, jar or can, 3 1/2 oz.
Beech-Nut, Swift _____

____ 15) Baby food, strained vegetables or fruit, jar or can, 4 1/2 - 5 oz.
Beech-Nut, Gerber, _____

____ 16) Tuna fish, white, solid, packed in oil, 6 1/2 oz. can
Bumble Bee, _____

____ 17) Corn flakes, 11-12 oz. package
Kellogg's _____

____ 18) Rice, white, long grain, 1 lb. package
Carolina _____

____ 19) White, granulated cane Sugar, 5 lb. bag
Domino, Jack Frost, _____

____ 20) Coffee, canned, per lb.
Savarin, _____

____ 21) Coffee, instant, 6 oz. jar
Savarin, _____

____ 22) Cola drink, carton of 6-12 oz. cans
Coca Cola, Pepsi Cola, _____

____ 23) Beer, domestic, carton of 6-12 oz. cans
Rheingold, _____

*Place "Q" in space if price was quoted to you.

Look for price of first brand name mentioned, if you cannot find it use alternative brand. Cross off names of brands you do no record price of. Please write down only the price of one brand.

MAYOR'S COUNCIL ON CONSUMER AFFAIRS

Consumer Price Survey

Name of Store_____ Size_____

Address of Store_____

Borough and District_____

Name of Surveyor_____

Date_____

List B

____ 1) Milk, advertised or store brand, per quart _____

____ 2) Eggs, grade A, large, white, per dozen _____

____ 3) Steak, sirloin, bone in, U.S. choice, per lb. _____

____ 4) Steak, chuck, bone in, U.S. choice, per lb. _____

____ 5) Chuck roast, boneless, U.S. choice, per lb. _____

____ 6) Hamburger, ground chuck, per lb. _____

____ 7) Pork chops, center cut, loin, No. 1 grade, per lb. _____

____ 8) Chicken, fresh, breasts, grade A or best quality, per lb. _____

____ 9) Chicken, whole, fryer, grade A or best quality, per lb. _____

____10) Bananas, yellow, per lb. _____

____11) Tomatoes, fresh, per lb. _____

____12) Potatoes, white, exclude large size or baking, 5 lb. bag _____

____13) Lettuce, head _____

____14) Dried beans, white (Navy) pea beans _____

APPENDIX B

MODIFIED DATA RANGES

COMMODITY	RANGE (cents)
1. Margarine	28 - 50
2. Cheese	33 - 55
3. Cottage Cheese	17 - 30
4. Flour	57 - 76
5. Peas	20 - 35
6. Corn	18 - 30
7. Green Beans	20 - 29
8. Broccoli	22 - 35
9. Orange Juice	15 - 29
10. Baby Food-Meat	17 - 30
11. Baby Food-Veg.	9 - 13
12. Tuna Fish	34 - 49
13. Corn Flakes	27 - 39
14. Rice	19 - 26
15. Sugar	59 - 79
16. Coffee-Canned	73 - 100
17. Coffee-Instant	75 - 120
18. Coca Cola	77 - 108
19. Beer	99 - 132
20. Milk	24 - 30
21. Eggs	47 - 73
22. Steak-Sirloin	89 - 129
23. Steak-Chuck	49 - 79
24. Chuck Roast	59 - 89
25. Pork Chops	79 - 139
26. Chicken Breasts	37 - 79
27. Chicken-Whole	27 - 59
28. Bananas	12 - 23
29. Tomatoes	23 - 69
30. Potatoes	20 - 79
31. Lettuce	19 - 45